July 15, 1969 J. GALAN ET AL 3,455,140

TOOL WITH WEDGE-OPERATED JAW SEGMENTS

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FIG. 2

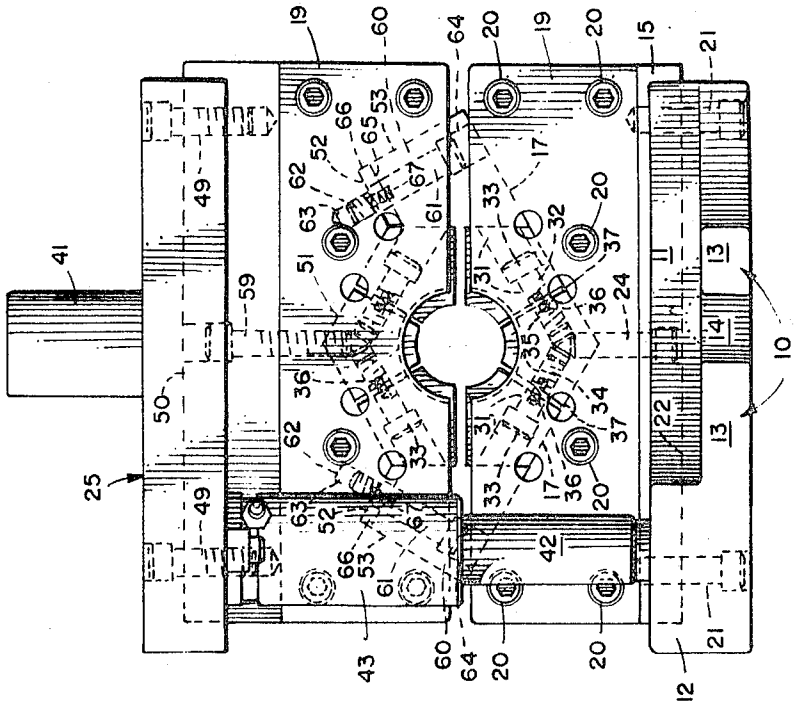
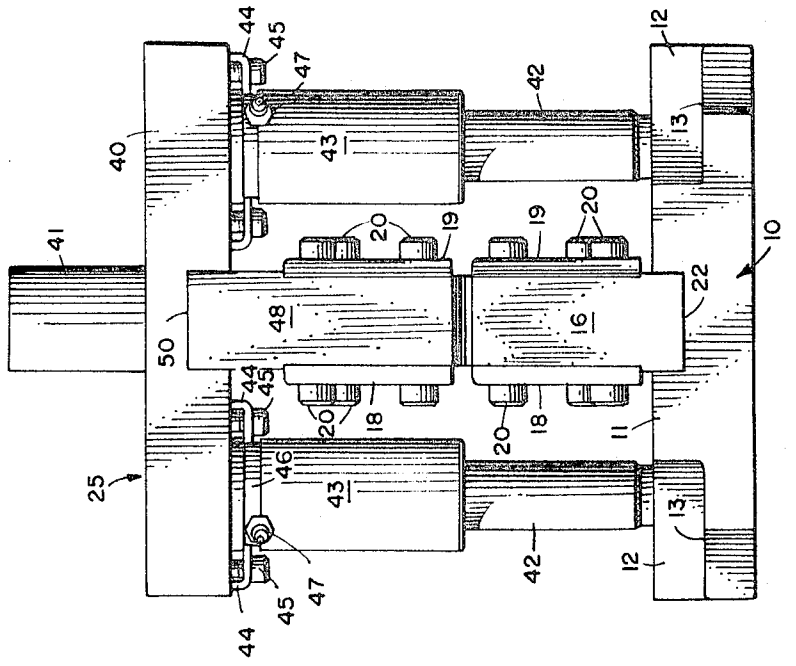


FIG. 1



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FIG. 5

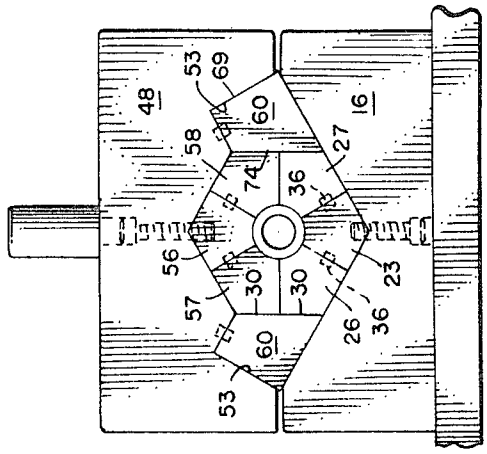


FIG. 4

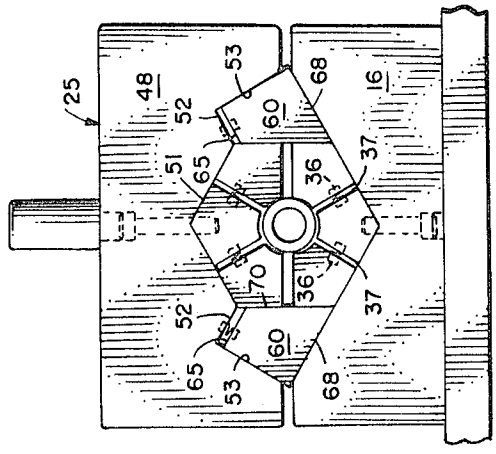
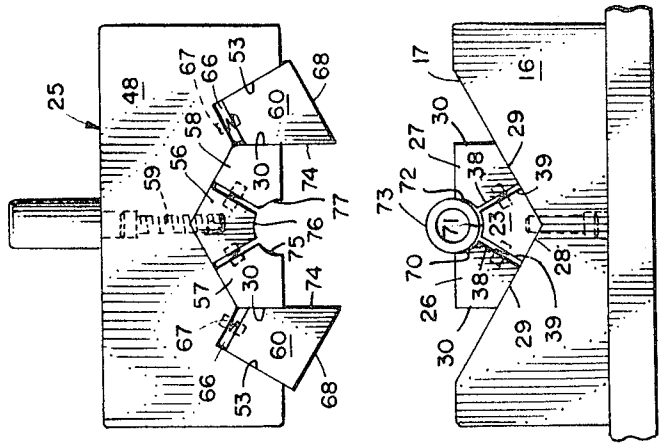


FIG. 3



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TOOL WITH WEDGE-OPERATED JAW SEGMENTS

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ABSTRACT OF THE DISCLOSURE

Crimping or clamping tool with fixed, lower jaw retainer and vertically movable, opposed, upper jaw retainer; each retainer having three crimping jaw segments, a fixed central jaw segment and side jaw segments movable toward and away from said central segment along diagonal, converging planes; wedge members movably held in one die retainer and having outer edges sliding on diagonal planes on respective retainers to move wedges laterally inwardly against said side segments and thereby move latter toward center segment when retainers are brought together; and springs biasing die jaw segments apart.

The present invention pertains to tools useful in the crimping or gripping of a workpiece, e.g., wherein tube stock or the like may be crimped, swaged or firmly but lightly held between opposed jaw members movable toward and away from each other.

A primary object of the invention is to provide a crimping tool of the character described which is accurate and reliable in its crimping function.

A further primary object is to provide a tool of the character described wherein its jaws include normally spaced, movable jaw segments which are brought together by movement along inclined planes by the action of wedge members acting on inclined planes.

A further object of the invention is to provide, in a preferred form of the invention, a tool with central, fixed, opposed jaw segments and wedge-operated, movable, side jaw segments movable along inclined planes toward the respective central segments to closed jaw position.

Brief summary of the invention

Briefly, the present invention relates to crimping or clamping tools embodying opposed jaw retainers movable toward and away from each other, e.g., a fixed retainer and a movable retainer reciprocable toward and away from the fixed retainer. Each retainer contains crimping or clamping jaws composed of jaw segments in normally spaced relation in open position. The jaw segments preferably comprise a fixed central jaw segment in each retainer with the crimping or clamping faces in opposed relationship in the direction of reciprocal movement of the movable die retainer and symmetric, respectively movable, side jaw segments movable toward and away from the central segment along respective diagonal, converging planes in each retainer. Wedge members are mounted in one die retainer with an inner wedge surface acting against the outer sides of the respective side jaw segments and with outer edges of the wedge members sliding on inclined planes on respective retainers when the respective jaws are brought into crimping or gripping relationship about the work piece. The respective movable jaw segments are moved from spaced relationship with the fixed, central segments to a closed, contacting relationship with said central segments by the action of the wedges to provide in the closed position the shape to be imparted by the closed

crimping jaw assembly or the approximate shape of the workpiece to be gripped by the tool. Upon release of the crimping or clamping action of the jaw segments, springs mounted therebetween urge the side jaw segments away from the central segment and also urge the wedges outwardly from the retainer in which the wedges are mounted.

Brief description of the drawings

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

FIG. 1 is a side elevation of the embodiment;

FIG. 2 is a front elevation thereof; and

FIGS. 3, 4 and 5, respectively, are diagrammatic views showing the positions of the wedge members and the movable jaw segments in the die retainers and the relationship thereof to a tubular workpiece with the die retainers in (a) open position, (b) a position wherein the wedge members of the upper die retainer first contact the inclined planes of the lower die retainer, and (c) fully closed or crimping position.

Description of the preferred embodiment

Referring to the drawings, the preferred embodimnet comprises a fixed base **10**. The latter comprises a central segment **11**, rear wings **12** and thinner side wings **13**. Slots **14**, for bolting the base to a mounting plate or base of the crimping or swaging machine or the like, are provided in the side wings **13**.

A retaining block **16** of the fixed retainer has a V-shaped, upper wall **17** providing converging, downwardly diagonal plane surfaces. A front jaw retaining plate **18** and a rear jaw retaining plate **19** are bolted by bolts **20** to the front and rear faces of the block **16**, thereby providing a V-shaped cavity in the upper face of the lower retainer. The block **16** is rigidly held in the groove **22** of the base **10** by bolts **21**. Similar plates **18** and **19** are bolted on the front and rear faces of upper jaw retainer block **48**.

The lower jaw assembly comprises a fixed jaw segment **23** positioned symmetrically at the bottom of the V-shaped wall **17**. It is held fixedly by the bolt **24**, which is threaded from the bottom of the block **16** into a tapped hole in the lower end of the die segment **23**. Shiftable jaw segments **26** and **27** are positioned on opposite sides of the segment **23**. The contiguous side walls of the shiftable die segments **26** and **27** are parallel with the respective sides of the fixed segment **23**.

As can be sen in FIGS. 2–5, the bottom edges of fixed segment **23** correspond in shape to the apex portion of the V-shaped wall **17**. The bottom edges **29** of the shiftable segments **26** and **27** are diagonal edges seated on and adapted to slide on the respective legs of the V-shaped wall **17** in directions toward and away from the fixed segment **23**.

The outer, side edges **30** of the movable segments **26** and **27** are preferably, though not essentially, vertically disposed, i.e., disposed in respective planes parallel with the direction of movement of the movable retainer **25**. The movement of jaw segments **26** and **27** toward and away from fixed die segment **23** is guided by providing countersunk holes **31**, the axes of which are parallel to the respective legs of the V-shaped upper wall, through the outer edges **30** to the inner side edges **38**. Respective bolts **33** having a smooth surface shoulder **32** have their respective threaded ends **34** threaded in tapped holes **35** in the contiguous edges of fixed segment **23** whereby the

movement of shiftable die segments 26 and 27 is guided by and limited by the smooth surface shoulders 32 and the heads of the bolts 33 with the contiguous edges 38 of the shiftable jaw segments and side edges 39 of the fixed segment remaining in parallel relationship. Each of the side edges 38 and 39 have a pair of opposed blind holes on opposite sides of the bolt 33 with a coil spring 36 mounted in each pair of opposed blind holes. Coil springs 36 urge the jaw segments 26 and 27 away from the segment 23, whereby the segments normally have a space 37 therebetween.

The movable retainer 25 comprises a base plate 40 having a stud 41 or other suitable means for mounting the movable retainer 25 in a reciprocable, power actuated head or other member of a crimping or other machine (not shown). Such machine may be a punch press or other machine having a reciprocable, power actuated member, e.g., machines with hydraulic or pneumatic actuated members, mechanical actuating members, or the like.

The movable retainer 25 is guided in reciprocal movement relative to the fixed die by the use of guide rods 42 fixedly secured to the fixed base 10 and telescoping sockets or cylinders 43 removably, but fixedly, attached to the upper base plate 40. The longitudinal axes of the rods 42 and the sockets or cylinders 43 are normal to the respective fixed base 10 and the movable base plate 40.

In the illustrated embodiment, the sockets or cylinders 43 are attached to the plate 40 by the use of mounting brackets 44 attached to the plate 40 by bolts 45. The ends of the horizontal legs of the brackets 44 seat in an annular groove 46 in each socket 43. The upper, closed ends of sockets or cylinders 43 are vented to the atmosphere by vent valves or vent members 47. The upper retainer block 48 is fixedly secured by bolts 49 in the groove 50 of the base plate 40. The lower wall of the retainer block 48 comprises symmetric diagonal walls forming a central, inverted-V, center segment 51, diagonally upwardly-extending wall segments 52 at the outer ends of the inverted-V segment, and diagonally downwardly extending walls 53 at the outer ends of the segments 52.

The jaw segments of the upper, movable retainer are similar to the previously described jaw segments of the fixed, lower die. The central, fixed jaw segment 56 is fixed in the apex portion of the inverted-V segment 51 by bolt 59. The shiftable jaw segments 57 and 58 have upper walls slidable on the inverted V-shaped wall of the center segment 51 and move in directions parallel to the legs of the inverted-V. The shiftable jaw segments 57 and 58 are mounted and guided by bolts 33 and are spring urged by pairs of springs 36 in the same manner as previously described above with respect to the jaw segments of the lower retainer.

The members for driving shiftable jaw segments 26, 27 and 57, 58 toward the respective fixed jaw segments 23 and 56 in the crimping or gripping operation are wedges 60. The latter are mounted in the space defined by the walls 52 and 53 and the outer edges of the shiftable jaw segments 57 and 58 by a smooth surface shank bolt 61 having a threaded shank portion 62 threaded in tapped hole 63 in each wall 52. The respective axes of bolts 61 are parallel to the walls 53, as are the axes of the countersunk holes 64 in which the shanks and heads of the respective bolts 61 are slidably mounted. The upper edge 65 of each wedge 60 is normally spaced by space 66 from each wall 52 whereby each wedge can be driven or moved upwardly in the aforedefined space.

Crimping or swaging action of the tool is illustrated semi-diagrammatically in FIGS. 3–5. With the upper and lower retainers spaced apart as shown in FIG. 3, the work piece, e.g., a tubular member 73 such as a hose sleeve coupling, or other member to be crimped or swaged, is placed in the cradle provided by the arcuate crimping faces 70–72 of jaw segments 23, 26 and 27 of the lower retainer. When the movable retainer 25 reaches the position shown in FIG. 4, the lower edges 68 of the wedges 60 bear flatly against the respective legs of the V-shaped upper wall 17 of the lower, fixed retainer block 16. As the movable retainer continues its movement toward the fixed die, the bottom edges 68 and the side edges 69 of the wedges 60 slide along the diagonal walls 17 and 53. The vector of movement of the wedges 60 is parallel to the respective axes of their countersunk holes 64 and bolts 61. The horizontal component of this vector causes the inner side edges 74 of wedges 60 to push laterally against the side edges 30 of the movable, jaw segments 26, 27, 57 and 58, whereby the segments move to a fully closed position as shown in FIG. 5. In this position the work piece 73 is crimped or swaged by the concerted action of the crimping faces 70–72 and 75–77 of the six die segments 23, 26, 27 and 56–58. The spaces between these segments are substantially completely closed at the completion of the crimping or swaging action, and the crimping faces 70–72 and 75–77 form a substantially closed circle.

When the movable retainer is retracted from the fixed retainer, the jaw segments, under the urging of springs 36, as well as the wedges 60 under the urging of springs 67, return to the spaced relationship shown in FIG. 3. The crimped or swaged work piece is removed, another work piece is placed in the tool as shown in FIG. 3, and the crimping cycle is repeated.

As shown in the drawings, the six jaw segments are symmetrically arranged with fixed jaw segments 23 and 56 symmetrically opposed along a center plane parallel to the relative movement of the retainers toward and away from each other. The perimeter of the outer edges of the six jaw segments is a symmetric hexagon, and wedges 60 preferably are trapezoids. The wedges 60, however, may be trapeziums, if desired. For simplicity of manufacture, the lower, diagonal edges 68 of wedge 60 contact and slide on the same converging, diagonal surfaces of V-wall 17 as do diagonal edges 29 of the movable jaw segments 26 and 27. If desired, however, the retainer block 16 may be made with each diagonal, converging leg of the upper wall 17 in two segments in different parallel or non-parallel planes, one segment for sliding support of the respective lower, diagonal edges 29 of movable jaw segments 26 and 27 and the other segments for flat, sliding contact with the respective lower edges 68 of wedges 60.

The tools of the invention may also be used to clamp or grip releasably a workpiece of a shape and size substantially corresponding to the opening of faces 70–72 and 75–77 when the jaw segments are in closed position. The operation of the tool is the same as the above-described crimping or swaging operation, but the jaw segments 23, 26, 27 and 56–58 are sized at faces 70–72 and 75–77 to grip rather than crimp or swage. These faces may be ridged or saw-toothed or otherwise modified to improve the gripping function.

Operation

Thus, the tool comprises a first jaw retainer and a second jaw retainer 25 movable toward and away from said first jaw retainer with a set of normally spaced, jaw segments in each jaw retainer. Each set of jaw segments comprises side jaw segments 26, 27 and 57, 58 movable toward and away from the center of each set of jaw segments. The jaws preferably comprise vertically opposed, fixed, center jaw segments 23 and 56, and a pair of laterally diagonally movable side jaw segments 26, 27 and 57, 58 on opposite sides of each fixed jaw segment in normally spaced relationship thereto. The wedge members 60 have inner side edges 74 adapted to contact respective outer side edges 30 of said side jaw segments. These wedge members are diagonally slidably mounted in one of said jaw retainers, preferably in movable jaw retainer 25. There is an inwardly diagonally sloping,

projecting edge **68** on each wedge member, and inwardly diagonally sloping wall portions **29** on the surface of said other jaw retainer face are substantially parallel therewith. The movable side jaw segments **26** and **27** are mounted for movement toward and away from the center jaw segment **23** in a direction parallel with said diagonally sloping wall portions **29**. The movable side jaw segments **57** and **58** are mounted in the jaw retainer **25** for movement toward and away from the fixed center jaw segment **56** at like angles to the horizontal plane. The sloping surfaces **29** serve as the means for imparting movement to said wedges laterally toward said centers of said jaw segments when said jaw retainers are brought together. The striking of sloping wedge edges **68** against the surfaces **29** causes upward and inward movement of the wedges, the lateral vector of which movement results in contact of the inner side edges **74** of said wedges and the outer side edges **30** of the movable jaw segments and pushing of the jaw segments **26, 27** and **57, 58** toward said centers to close the normally spaced jaw members.

A preferred use of the tool herein is for crimping or swaging of tubular stock. The crimping or swaging tool comprises the fixed crimping jaw retainer and the movable crimping jaw retainer **25** movable toward and away from said first jaw retainer. There is a V-shaped face **17** in said fixed retainer facing said movable jaw retainer. The movable retainer **25** has an inverted V-shaped face **51** of less width than the V-shaped face **17**. The apices of said V-shaped and inverted V-shaped faces are oppositely disposed. The fixed jaw segments **23** and **56** are mounted at the apices of the respective faces and have side walls substantially at right angles to the respective legs of said faces. A pair of movable crimping jaw segments **26, 27** and **57, 58** are disposed on respective opposite sides of the fixed jaw segments. One edge of each movable jaw segment is respectively parallel with the contiguous side edge of the fixed jaw segments and normally spaced therefrom by resilient biasing means, e.g., springs **36**. The outer side edges **30** of vertically opposed movable jaw segments **26, 57** and **27, 58** are in a common vertical plane. Another edge of each movable jaw segment is parallel with and slidable on the respective legs of said V-shaped and inverted V-shaped faces. The wedge means presses against said outer side edges **30** in a direction toward center jaw segments when said crimping jaw retainers are brought together to close said jaws upon movement of said side jaw segments toward their respective center jaw segment.

The wedges **60** are slidably mounted in the movable retainer **25** in recesses therein respectively formed by an upwardly and outwardly sloping face **52** and a downwardly and outwardly sloping face **53**. The outer side edges of said wedges are slidable along the last-mentioned faces. The lower projecting edges **68** of said wedges are adapted to strike the respective legs **29** of the V-shaped face **17** when the jaw retainers are brought together to impart upward and inward movement to said wedges, which in turn impart movement of said movable crimping jaws toward their respective fixed jaw segments. The jaw segments in closed, crimping relationship preferably have a substantially regular hexagonal periphery, and the crimping jaw faces **70–72** and **75–77** collectively form a circle at the center of the jaw assembly.

The springs **36** between opposing faces of said fixed jaw segments and respective side jaw segments bias the latter away from the former, and additional springs **67** between the upwardly and outwardly sloping faces **52** of said movable retainer and the upper edge **65** of each wedge member bias said wedge members away from said faces. The upwardly and outwardly sloping faces **52** preferably are substantially parallel with the respective opposing legs **29** of said V-shaped face **17** of the fixed retainer. The downwardly and outwardly sloping faces **53** are preferably at right angles to the respective upwardly and outwardly sloping faces **52**. The wedge members preferably have the shape of regular trapezoids.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A tool comprising a first jaw retainer and a second jaw retainer movable toward and away from said first jaw retainer, a set of normally spaced, jaw segments in each jaw retainer, each set of jaw segments including side jaw segments movable toward and away from the center of each set of jaw segments; wedge members having inner side edges adapted to contact respective outer side edges of said side jaw segments; and means for imparting movement to said wedges laterally toward said center of said jaw segments when said jaw retainers are brought together to cause contact of said inner side edges and said outer side edges and pushing of said side jaw segments toward said centers to close said normally spaced jaw segments.

2. A tool as claimed in claim **1** wherein said jaw segments respectively comprise opposed, fixed center jaw segments and a pair of laterally diagonally movable side jaw segments on opposite sides of each fixed jaw segment in normally spaced relationship thereto, said wedge members being diagonally slidably mounted in one of said jaw retainers, and a projecting edge on said wedge members adapted to strike the other jaw retainer wherein said retainers are brought together and impart diagonal movement to said movable side jaw segments toward respective center jaw segments by sideward movement of said wedges.

3. A tool as claimed in claim **2** wherein said projecting edge of each of said wedge members is oriented diagonally inwardly, and the portion of said other jaw retainer contacted by the respective projecting edge is a diagonal surface substantially parallel with said respective projecting edges.

4. A tool as claimed in claim **1** wherein said jaw segments respectively comprise opposed, fixed, center jaw segments and a pair of laterally diagonally movable side jaw segments on opposite sides of each fixed jaw segment in normally spaced relationship thereto, said wedge members being diagonally slidably mounted in one of said jaw retainers, an inwardly diagonally sloping projecting edge on each wedge member, inwardly diagonally sloping wall portions on the other jaw retainer opposite said projecting edges and substantially parallel therewith, means mounting said movable side jaw segments for movement toward and away from the center jaw segment in said other jaw retainer in a direction parallel with said inwardly sloping wall portions, means mounting said movable side jaw segments in said one of said jaw retainers for movement toward and away from the fixed center jaw segment thereof, and resilient means biasing said side jaw segments away from their respective fixed, center jaw segments.

5. A crimping tool comprising a fixed lower crimping jaw retainer and a movable upper crimping jaw retainer movable toward and away from said first jaw retainer, a V-shaped face in said fixed retainer facing said movable jaw retainer, an inverted V-shaped face of less width than said first-mentioned V-shaped face and facing said V-shaped face, the apices of said V-shaped and inverted V-shaped faces being oppositely disposed, a fixed jaw segment mounted at the apex of the respective faces and having side walls substantially at right angles to the respective legs of said faces, a pair of movable crimping jaw segments disposed on respective opposite sides of each

fixed jew segment, the inner side edge of each movable jaw segment being respectively parallel with the contiguous side edge of the fixed jaw segments and normally spaced therefrom by resilient biasing means, the outer side edges of vertically opposed movable jaw segments being vertical, another edge of each movable jaw segment being parallel with and slidable on the respective legs of said V-shaped and inverted V-shaped faces, and wedge means having a vertical inner edge adapted to press against said outer side edges when said crimping jaw retainers are brought together to close said jaws upon movement of said side jaw segments toward their respective center jaw segment.

6. A tool as claimed in claim 5 wherein said wedge means are slidably mounted in said movable retainer in recesses therein respectively formed by an upwardly and outwardly sloping face and a downwardly and outwardly sloping face, the outer side edges of said wedges being slidable along said last-mentioned face, and lower projecting edges of said wedges adapted to strike the respective legs of the V-shaped face of said first retainer when said crimping jaws are brought together to impart upward and inward movement to said wedges and press their respective vertical inner edges against said outer side edges of said movable crimping jaw segments toward their respective fixed jaw segments.

7. A tool as claimed in claim 6 wherein said jaw segments, when in closed, crimping relationship, have a regular hexagonal periphery and the crimping jaw faces of said jaw segments collectively form a circle at the center of the jaw assembly.

8. A tool as claimed in claim 6, springs between opposing faces of said fixed jaw segments and respective side

jaw segments biasing the latter away from the former, and additional springs between said upwardly and outwardly sloping face of said movable retainer and the respective upper edge of said wedge members for biasing said wedge away from respective outwardly and inwardly sloping faces, said upwardly and outwardly open face being substantially parallel with the respective opposing legs of said V-shaped face of the fixed retainer, said downwardly and outwardly said sloping faces being at right angles to the respective upwardly and outwardly sloping faces, and said wedge members having the shape of regular trapezoids with the inner edges thereof parallel with the outer edges of said movable jaw segments.

9. A crimping tool as claimed in claim 7 wherein said movable jaw segments have bores parallel with the respective V-shaped and inverted V-shaped faces, and a smooth shank bolt with the smooth shank thereof in each of said bores and the threaded end threaded into the side edges of said fixed jaw segments for holding and guiding the movement of said side jaw segments toward and away from their respective fixed jaw segment.

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